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Compliance Guideline for Meat and Poultry Jerky

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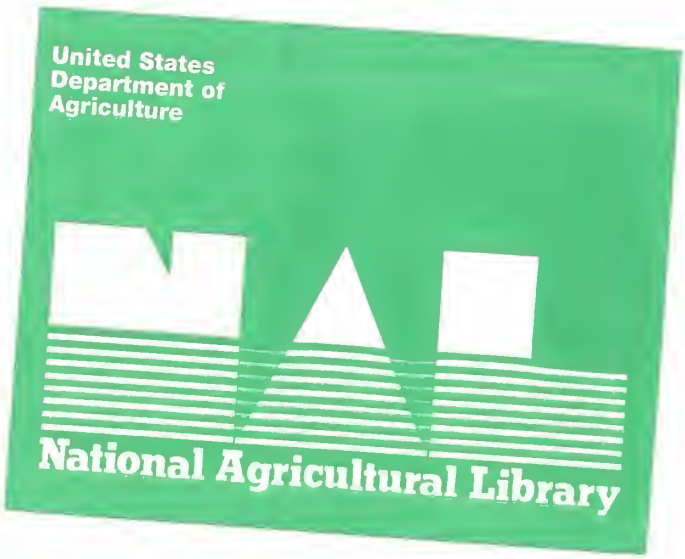
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Compliance Guideline for Meat and Poultry Jerky

Meat or poultry jerky is a dried product that is generally considered to be shelf-stable (i.e., does not require refrigeration after proper processing). In general the processing of jerky includes slicing or forming of the meat or poultry ingredient, marinating the strips, heating, and then drying. The heating and drying are sometimes done in one step. In either case it is critical that the heating accompanied by adequate humidity precede the drying. This compliance guideline is intended to provide updated information regarding the safe manufacture of jerky. In addition, the generic HACCP model for heat treated, shelf stable products has been revised to include material in this guideline and posted on the FSIS website.

In early Fall 2003, FSIS became aware that manufacturers of jerky may not be adequately accounting for the proper lethality of the jerky product, accomplished by heating, prior to the onset of drying. Furthermore, FSIS became aware that some manufacturers may be relying upon a maximum moisture-protein-ratio (MPR) rather than water activity for determining adequate drying. FSIS is clarifying that MPR should not be used to verify proper drying for jerky-type products. Instead, water activity, as measured by laboratory procedure, should be used to verify that proper drying has occurred to produce a shelf-stable product. For further clarification regarding MPR, an MPR of 0.75:1 or less is part of the standard of identity for jerky but is not to be used for food safety purposes.

The following are the steps that may be used in the manufacture of jerky. Not all steps (some are listed as optional) may be included in an establishment's process. The steps listed as heating and drying are not separated by time but follow consecutively. Heating is the lethality step in the process, and drying serves to stabilize the product.

Step 1 - Strip preparation: Whole muscle is sliced or ground; product is formed into strips.

Step 2 – Marination (optional): The strips are then marinated in a solution that often contains soy sauce, sugar, and flavoring ingredients.

Step 3 - Interventions (optional): Interventions before and after marinating the strips of raw product have been shown to increase the level of pathogen reduction greater than that achieved by heating and drying alone and may reduce contamination levels acquired post-process. For example heating the meat or poultry in the marinade to achieve a minimum 160°F will provide an immediate reduction of *Salmonella* (Harrison and Harrison, 1996). Applying an acid dip, such as 5 % acetic acid, before the marinade also can increase the log reduction during drying and decrease the level of contamination that may occur post-processing (Calicioglu, 2002 & 2003). Interventions should not replace or reduce the amount of heat and humidity applied during the process but rather should be used to increase the level of pathogen reduction.

Step 4 - Lethality treatment (required): The establishment must apply a treatment to inactivate the biological hazards identified in the hazard analysis. For beef, lamb, pork, and poultry products, these hazards would most likely include the microbiological hazards from: *Salmonella* spp., *Listeria monocytogenes,* and *Staphylococcus aureus*. For beef products, *Escherichia coli* O157:H7 also should be considered a potential hazard. In recent years, several jerky products have been found to be adulterated with *Salmonella*; *E. coli* O157:H7 has been found in deer jerky.

The time-temperature combinations including the humidity specifications provided in the Compliance Guidelines for cooking whole beef may be used for beef jerky. The same humidity specifications should also be used for poultry jerky (which is heated to at least 160°F). Those time-temperature tables are based on wet-heat. Failure to apply humidity may dry the product but the bacteria will become more heat resistant (Goepfert, 1970). The research supporting the humidity requirement for roasting beef showed that without adequate humidity there was greater survival of *Salmonella* on the surface of the roasts than in the interior. The level of pathogen reduction attained by using the Compliance Guidelines for cooking whole beef should be sufficient to provide a safe product.

The heating temperature and humidity (e.g., steam) are critical to the lethality of the heating process. As the water activity is reduced, the heat resistance of bacteria increases (Goepfert, 1970). Therefore, if adequate humidity is not maintained during heating, the time at that temperature to eliminate *Salmonella* will be greatly increased.

Establishments or their processing authorities may develop customized procedures that achieve an appropriate reduction of pathogens throughout the product. An alternative or custom process must be validated (9 CFR 417.4).

The customized procedures may be developed by using information obtained from the literature or from unpublished studies that are scientifically valid, or comparing the methods used by the establishment with established procedures that have been validated to achieve the required $\log_{10}$ reduction of the pathogen. Sampling results should not be used to validate these procedures. Rather, the demonstration should be based on scientific rationale, supported by experimental data. Validation by inoculated pack or challenge studies are based on scientific rationale and provide the necessary data. Challenge studies are an excellent means to validate a process.

The process should be monitored using wet and dry bulb thermometers (values in Appendix A are wet bulb values). The use of wet and dry bulb measurements can be used to determine relative humidity (http://members.nuvox.net/~on.jwclymer/wet.html). For example, a difference of 2°F might indicate approximately 94% relative humidity. Wet and dry bulb temperatures should not differ by more than 3 °F. A temperature difference greater than 3°F shows the needed humidity is not being maintained.

FSIS has become aware that altitude may affect the degree of lethality for a given heat process. At high altitude, the amount of humidity to achieve a certain log reduction of pathogens may need to be increased. Many processing failures in the manufacture of

jerky have occurred in establishments located at high altitudes.

Step 5 – Drying (mandatory): After the lethality treatment, the product should be dried to meet the MPR product standard and to stabilize the finished product for food safety purposes. If the product receives an inadequate lethality and is insufficiently dried, *S. aureus* is a potential hazard. *S. aureus* is not expected to grow in properly dried products.

The establishment should verify the water activity to demonstrate that the product has attained the critical limit for shelf stability. (For non-shelf stable jerky, the processor would not have to measure water activity but this product must bear the handling statement prescribed by 9 CFR 317.2(k) – "Keep Refrigerated," "Perishable Keep Under Refrigeration," or such similar statement.).

Manufacturers should not use MPR as a measure of proper drying for shelf-stability. This is because MPR is merely a product standard and because the water activity can vary greatly at any given MPR (as a result of the different solutes such as sugar and salt). Many manufacturers may employ the practice of bending pieces of jerky as a test of dryness; they interpret the amount of remaining pliability as an indicator of inadequate drying. This physical indicator should not be used to validate proper drying. Instead, a laboratory test for water activity should be used to verify proper drying.

A suggested water activity critical limit for stabilization of jerky is $\leq$0.70 for product in contact with air. That water activity should control growth of all bacterial pathogens of concern and most types of molds in most environments. While a water activity of $\leq$0.85 has been common for the control of *S. aureus*, it is not nearly low enough to exclude mold growth unless the processor adds additional controls.

Step 6 - Handling: The establishment's Sanitation SOPs (9 CFR 416), should ensure that product is properly handled to prevent re-contamination or cross-contamination.

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